Explained
LEAFCUTTER ANTS

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As the species that has anointed itself as Homo sapiens (literally translating to intelligent human), even the scientifically uninitiated among us have a rough idea of what it means to be intelligent. Anatomically modern humans have existed for about 100,000 years now. We have fossil records of early hunter-gatherer societies from 10,000 years ago. Gradually, settlements emerged as agriculture and animal husbandry demanded these proto-societies to grow roots, literally and figuratively. With a surplus of food, our social groups started to grow and labour became specialised, giving rise to a diversity of professions and vocations.

This is where, according to most anthropologists, civilisation started. After delving more into the specifics of the animal world, we now acknowledge that many species possess both analytical and social intelligence. However, it is not an uncommon belief that humans are the only species that have made it into "the civilisation club." Surely, no other animal has gone through the agricultural revolution, right?

Well, it turns out there are at least 55 species of ants, known as the leafcutter ants, that have unlocked not only primitive agriculture but crop domestication, labour specialisation, and even the construction of megastructures.

Biological division of labour

A leafcutter colony begins with a single queen, who mates with three to eight males during a nuptial flight, a choreographed mating dance high up above the forest floor. A queen can then store the sperms (male sex cells) in an abdominal sac and produce a variety of worker ants over her lifespan of about 10 years. Each queen carries a specific fungus with her to an underground lair within which she lays her first batch of daughters, the 1.5 mm long Minims and 2.2 mm long Minors. The smallest Minim ants take over the cultivation of the fungus, take care of the larvae, and bring back foliage from around the nest, essential to keep the fungus growing, whilst the queen only lays eggs from here on out. The Minors can forage a bit further from the nest and act as the colony's first line of defence.

As the fungus grows, it requires more leaves as substrate. And, thus, kilometres of forest foliage are cleared to construct highways which better facilitate the transport of leaves to meet the needs of the colony. But files of undefended Minims and Minors carrying leaves over vast distances invite predators that the Minors alone are incapable of fighting off. This is when the queen starts laying eggs that hatch into 16 mm long giants called Majors and even larger Super-Majors. The sole purpose of this soldier caste is the protection of the home base and the highways that feed the colony.

Further down the line, at a point in the colony's continuous growth, the Minims reach their biological limit. They are unable to procure the amount of leaves required to sustain the growing fungus crop. And so, another biological faction — the Mediae, specialised in foraging leaves from far-off sources — emerges to increase the supply and overcome this hurdle. Many a time, small Minims are seen riding on top of homebound leaves being carried by the Mediae, to keep a lookout for potential predators.

The queen's descendants range from the minuscule Minims to the massive Majors. Although we understand the physical variation of these castes results from the sperm cells acquired from multiple partners during the nuptial flight, how the queen balances the delicate ratio of Minims, Minors, Mediae, Majors, and Super-Majors remains unknown.

Communication is key

The complexity of our languages is undoubtedly a pillar that supports our civilisation. Language is the tool being used even this very moment to communicate minute facts about an insect species. While leaf-cutters may not participate in reading circles discussing human civilisation (that we know of), their modes of communication support both phonetic and chemical dimensions.

Worker ants, either under attack from predators or buried underground accidentally, can vibrate their thoracic (chest) regions to produce distress signals. They're also capable of producing vibrations of a different frequency to attract their comrades to a delicious new food source their foraging party has discovered.

Certain chemicals called pheromones are used for chemical communication in the form of marking lanes. Similar to how we use traffic signs and lights to regulate traffic flow, ant trails convey traffic signals by the scent of pheromones. Ants diverging from their trails are guided back to these multiple-lane highways solely through olfaction. One might even say, this altruistic traffic flow results in fewer quarrels or collisions compared to peak-hour human traffic.

The domestication of fungus

The ants themselves lack the enzymes (biological chemicals) to digest the cellulose found in leaves. They depend on a specific type of fungus, Leucoagaricus gongylophorus, to digest the food externally. The ants then consume the fungus along with the digested nutrients. What's even more fascinating is that this form of fungus doesn't exist naturally anywhere else, only in leaf-cutter colonies. It depends on the precise atmospheric parameters within a colony and the leaves that the workers provide as substrate. This resembles how we've domesticated wild versions of grain-crops, fruits, or vegetables for our benefit in such a way that these plants cannot survive without our agricultural practices.

The symbiotic relationship between fungus and leaf-cutters has evolved over millions of years, with colonies with better yield of the fungus supporting larger colonies and populations ranging in the millions, much like human cities.

As human beings, we are accustomed to branding our form of individualistic intelligence as superior. After all, look at all that we've accomplished. But intelligence itself lies within a spectrum as well, with human beings leaning more towards the individualistic and leaf-cutters positioned more towards the collective. And as mentioned above, collective intelligence can lead to communication, planned agriculture, and specialisation of labour as well.

Yes, it's an imaginative liberty to call a leafcutter colony a city, but the parallels are evolutionarily significant. Altruism dictates that a worker ant put the needs of the colony above the needs of the individual. With so much polarisation all around us, we might look at these tiny creatures, realise how impressively close to a human civilisation they've constructed, and take a page out of their altruistic playbook once in a while. For all the problems our civilisations and our societies may have, we humans are nothing if not adaptable.